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भारतीय मानक

अर्धचालक युक्तियाँ – समाकलित परिपथ

भाग 3 अंकीय समाकलित परिपथ — मापन पद्धतियाँ

अनुभाग 1 सामान्य

Indian Standard

SEMICONDUCTOR DEVICES – INTEGRATED CIRCUITS

PART 3 DIGITAL INTEGRATED CIRCUITS — MEASURING METHODS

Section 1 General

UDC 621·3·049·77·037·37 : 621·317·3

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

October 1992 Price Group 2

Semiconductor Devices and Integrated Circuits Sectional Committee, LTD 010

FOREWORD

This Indian Standard (Part 3/Sec 1) was adopted by the Bureau of Indian Standards, after the draft finalized by the Semiconductor Devices and Integrated Circuits Sectional Committee had been approved by the Electronics and Telecommunications Division Council.

This standard is one of a series of Indian Standards on measuring methods of digital integrated circuits. Other sections of this part are:

Section 2 Static Characteristics

Section 3 Dynamic Measurements

Subsequent parts of this standard will cover detailed methods of measurement for the various characteristics covered by the appropriate standards on essential ratings and characteristics of digital integrated circuits.

When more than one method of measurement of a particular characteristic are described, it is implied that any one method will be suitable. These methods may vary considerably in regard to accuracy desired, ease of measurements, etc.

While preparing this standard, assistance has been derived from IEC Pub 748-2 'Semiconductor devices, Integrated circuits — Part 2 : Digital integrated circuits', issued by the International Electrotechnical Commission (IEC).

In reporting the results of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'.

Indian Standard

SEMICONDUCTOR DEVICES – INTEGRATED CIRCUITS

PART 3 DIGITAL INTEGRATED CIRCUITS — MEASURING METHODS

Section 1 General

1 SCOPE

This standard (Part 3/Sec 1) provides general information on measuring methods of digital integrated circuits.

2 REFERENCES

The following Indian Standards are necessary adjuncts to this standard:

IS No.	*Title*
1885 (Part 7/Sec 5) : 1971	Electrotechnical vocabulary: Part 7 Semiconductor devices, Section 5 Integrated circuits and microelectronics
3715 (Part 1) : 1971	Letter symbols for semiconductor devices: Part 1 General aspects (*first revision*)
12970 (Part 1) : 1990	Semiconductor devices—Integrated circuits : Part 1 General
12970 (Part 3/Sec 3) : 1992	Semiconductor devices—Integrated circuits : Part 3 Digital integrated circuits—Measuring methods, Section 3 Dynamic measurements

3 TERMINOLOGY

For the purpose of this standard the terms and definitions given in IS 1885 (Part 7/Sec 5) : 1971 and provisions of 3 of IS 12970 (Part 1) : 1990 shall be applicable.

4 LETTER SYMBOLS

For the purpose of this standard, the letter symbols given in IS 3715 (Part 1) : 1971 shall be applicable.

5 BASIC REQUIREMENTS

Provisions of 6 of IS 12970 (Part 1) : 1990 shall apply unless otherwise stated.

6 SPECIFIC REQUIREMENTS

6.1 General Requirements for Static and Dynamic Measurements

6.1.1 For each measurement, supply voltages or current shall be within ±1 percent of the specified values, unless otherwise stated.

6.1.2 The ambient temperature of the device being measured shall be within ±2°C of the specified value, unless otherwise stated.

6.1.3 Where no electrical conditions are specified for a given terminal, it shall be left unconnected.

6.1.4 The reference point(s) for voltage measurements shall be stated.

NOTE — The reference point for signal voltage measurements is not necessarily the same as that for supply voltages.

6.1.5 When a device has internal memory or hysteresis, a presetting cycle may be required before each measurement.

6.1.6 The device shall be operated at a set of conditions within the range of 'recommended operating conditions' unless otherwise stated.

6.1.7 Prior to carrying out the following measurements, it shall first be established that, for each combination of inputs, the output conforms to the details given in the relevent function table, except when this function table is verified by the measurements themselves.

6.2 Specified Conditions for Static Characteristics

6.2.1 *Measurement of Output Voltage or Current*

The following conditions shall be stated (*see* Note):

a) Ambient or reference-point temperature,
b) Values of supply voltages or currents,
c) Conditions at each input terminal,
d) Conditions at the output terminal selected for the measurement, and
e) Conditions at all other output terminals.

NOTE — The measuring conditions for a 'low' output can be different from the measuring conditions for a 'high' output.

6.2.2 *Measurement of Input Voltage or Current*

The following conditions shall be stated (*see* Note)

a) Ambient or reference-point temperature,
b) Values of supply voltages or currents,
c) Conditions at each output terminal,
d) Conditions at the input terminal selected for the measurement, and
e) Conditions at all other input terminals.

NOTE — The measuring conditions for a 'low' input can be different from the measuring conditions for a 'high' input.

Some devices having internal memory or hysteresis may have more than one input impedance value for a given input level, in which case more than one measurement may be necessary.

6.2.3 *Measurement of Power Supply Current Under Static Condition*

The following conditions shall be stated:

a) Ambient or reference-point temperature,
b) Values of supply voltages or V_{cc}, V_{DD},
c) Conditions at each terminal, and
d) Conditions at each input terminal.

6.3 Specified Condition for Dynamic Characteristics

The conditions are given with the measuring methods. [*see* IS 12970 (Part 3/Sec 3)] : 1992.

7 APPLICATION MATRIX FOR THE MEASURING METHODS — *see* Table 1.

Table 1 Application Matrix for the Measuring Methods

Test Method No.	Characteristics to be Measured	Categories, Sub-categories												
		Combinatorial Circuit	Sequential Circuits			Counters	Shift Registers		Memories			Micro Processors		
			Mono stable	Bistable	Astable		Static	Dynamic	ROM	RAM static	RAM dynamic			
37	High-level and low-level output voltages	X	X	X		X	X	X	X	X	X			
38	High-level and low-level output currents	X	X	X		X	X	X	X	X	X			
40	Short-circuit output current	X	X	X		X	X	X	X	X	X			
41	Power supply current under static conditions	X	X	X		X	X	X	X	X	X			
48	(Input) Threshold voltage and hysteresis voltage		X	X										
1	Total current drawn from the power supplies under dynamic conditions	X	X	X		X	X	X						
2	Power supplied though the clock line	X		X										
6	Input and output capacitances for large-signal operation	X	X	X		X	X	X	X	X	X			
11	Equivalent input and output capacitances, equivalent input and output resistances	X	X	X		X	X	X	X	X	X			

Table 1 Application Matrix for Measuring Methods (*concluded*)

Test Method No.	Characteristics to be Measured	Categories, Sub-categories												
		Combinatorial Circuit	Sequential Circuits			Counters	Shift Registers		Memories			Micro Processors		
			Mono stable	Bistable	Astable		Static	Dynamic	ROM	RAM static	RAM dynamic			
3	Propagation times (bipolar circuits)	X	X	X		X	X	X	X	X	X			
7	Propagation times (MDS circuits)	X	X	X		X	X	X	X	X	X			
4	Delay and transition times (bipolar circuits)	X	X	X		X	X	X	X	X	X			
5	Delay & transition times (MDS circuits)	X	X	X		X	X	X	X	X	X			
8	Set-up time		X	X		X	X	X	X	X	X			
9	Hold time		X	X		X	X	X	X	X	X			
36	Resolution time			X		X	X	X	X	X	X			
49	Output enable and disable times (for three-stable outputs)	X	X	X		X	X	X	X	X	X			
50	To specific times for memories								X	X	X			
10	Switching frequency			X		X	X	X	X	X	X			

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